

# Predictors of Hospital Outcome in Patients with Cerebral Venous Thrombosis

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*Background:* The studies regarding clinical presentations, risk factors, and outcomes of cerebral venous thrombosis (CVT) in Thai people are scarce. This study aims to identify predictors of hospital outcomes among the Thai patients with CVT. *Methods:* Patients diagnosed with CVT in Songklanagarind Hospital from January 2002 to December 2013 were identified from computerized medical record system. Demographic data, clinical presentations, associated factors, method of neuroimaging studies and results, treatment, and hospital outcomes were presented by descriptive statistics. Predictors of hospital outcomes were analyzed by both univariate and multivariate logistic regression analysis. *Results:* There were 90 patients with a diagnosis of CVT. The mean age ( $\pm$ standard deviation) was 41.22 ( $\pm$ 17.13) years (range, 15-80). The common clinical presentations were focal neurologic deficits (36.7%), seizure (33.3%), and cavernous sinus syndrome (32.2%). The common associated conditions were intracranial or paracranial infections (30.0%) and cancer (11.1%). Intracranial hemorrhage was found in 33 patients (36.7%). Forty-seven patients (52.2%) were dependent or death (Modified Rankin Scale [mRS], 3-6) on hospital discharge. Eleven patients (12.2%) were dead, of which 7 cases (7.78%) were CVT-related deaths. The independent predictors of dependency or death (mRS, 3-6) identified by multivariate logistic regression analysis were focal neurologic (odds ratio [OR], 14.26; 95% confidence interval [CI], 2.28-89.04;  $P = .001$ ), mRS score of 3-5 on admission (OR, 35.26; 95% CI, 7.30-170.42;  $P = .000$ ), and seizure (OR, .19; 95% CI, .03-1.02;  $P = .037$ ). *Conclusions:* Focal neurologic deficit and severely disabled patients (mRS, 3-5) on admission were independent predictors of dependency or death in CVT patients. However, seizure predicted the lower incidence of dependency or death. The characteristic findings of CVT among Thai patients were the higher incidence of cavernous sinus syndrome and rhinosinal or intracranial infection. **Key Words:** Cerebral venous thrombosis—predictors—hospital outcome—Thai people—cavernous sinus syndrome—rhinosinal infection.  
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## Introduction

Cerebral venous thrombosis (CVT) is a serious neurologic condition leading to disability and death. The incidence of CVT was 3 to 4 cases per million people in the western countries.<sup>1</sup> The obstruction of cerebral venous circulation caused both focal cerebral venous infarction and diffuse brain edema resulting in severe intracranial hypertension.<sup>1</sup>

The clinical presentations of CVT were variable.<sup>2</sup> The studies regarding epidemiology, clinical presentations, risk factors, managements, and outcomes of CVT in Thai people are scarce.<sup>3</sup> The primary aim of this study was to

identify the predictors of hospital outcomes among patients with CVT treated in a medical teaching hospital.

## Material and Methods

This retrospective case control study enrolled all patients diagnosed with CVT by International Classification of Diseases, the Tenth Revision under the codes of I636 (cerebral infarction due to CVT), I676 (nonpyogenic thrombosis of intracranial venous system), O225 (CVT in pregnancy), and G08 (intracranial and intraspinal phlebitis and thrombophlebitis). The medical records of CVT cases from January 2002 to December 2013 in Songklanagarind Hospital, a medical teaching hospital in south of Thailand, were reviewed. All of the patients enrolled in this study had at least one of the following neuroradiological studies to confirm the diagnosis of CVT: computed tomography (CT) scan, magnetic resonance imaging (MRI), magnetic resonance venography (MRV), or cerebral angiography. Patients' demographic data, clinical presentations, associated factors of CVT, methods of neuroimaging studies and their results, treatments, and hospital outcomes were demonstrated and analyzed.

The clinical presentations were classified into 5 separate neurologic syndromes which were specifically defined as the following: (1) focal neurologic deficits (either focal motor or sensory disorder); (2) isolated intracranial hypertension (the combination of progressive headache, vomiting, and papilledema with or without bilateral abducens nerves palsy, but no other focal neurologic abnormality); (3) cavernous sinus syndrome (painful ophthalmoplegia, chemosis, proptosis, and combination of at least 2 of the following cranial neuropathies: oculomotor, trochlear, the first division of trigeminal or abducens neuropathy); (4) isolated headache (headache without abnormal neurologic sign); and (5) seizure (whichever type of seizure). Level of consciousness was evaluated by the Glasgow Coma Score (GCS) scale. Hospital outcomes were evaluated by Modified Rankin Scale (mRS) and divided into nondependency (mRS, 0-2) and dependency or death (mRS, 3-6). The cause of death was classified into CVT-related death that was brain herniation and non-CVT-related death, which included all the other causes of death.

Continuous demographic data were summarized as mean  $\pm$  standard deviation and discrete data as number and percentage. Identification of factors associated with outcomes (dependency or death vs. non dependency) was initially analyzed using univariate  $\chi^2$  test. The statistically significant factors ( $P < .2$ ) were further analyzed by multivariate logistic regression analysis to identify the independent predictors of the outcomes ( $P < .5$ ). Data analysis was processed on SPSS Statistics Bass 17.0 (SPSS Inc. Chicago, IL). The study protocol was reviewed and approved by Ethics Committee of Faculty of Medicine, Prince of Songkla University.

## Results

Ninety of 107 patients diagnosed with CVT were eligible for this study. There were 41 males (45.6%) and 49 females (54.4%) with a male to female ratio of 1:1.19. The mean age of the patients was 41.22 years (standard deviation, 17.13; range, 15-80 years). The most common clinical presentations were focal neurologic deficits found in 33 patients (36.7%), followed by seizure in 30 patients (33.3%), cavernous sinus syndrome in 29 patients (32.2%), GCS 13 or less in 16 patients (17.8%), isolated headache in 10 patients (11.1%), and isolated intracranial hypertension in 9 patients (10.0%). Fifty-six patients (62.2%) had a single clinical presentation. Twenty-six patients (28.9%) had 2 clinical presentations. Seven patients (7.8%) had more than 2 clinical presentations. One patient (1.1%) was asymptomatic with accidentally found CVT by a CT scan for evaluation of chronic otitis media. Fifty-four patients (60.0%) had mRS score of 3-5 (dependency) on admission.

The diagnosis of CVT was established by the presenting neurologic symptoms and signs plus various combinations of neuroimaging studies. Some patients might undergo more than 1 imaging method. The sites of cerebral venous occlusions were demonstrated by a CT scan in 73 patients (81.1%), an MRI in 68 patients (75.6%), an MRV in 37 patients (41.1%), and a cerebral angiography in 14 patients (15.6%). Most patients underwent more than 1 method of neuroimaging. The common combination of neuroimaging studies needed for diagnosis were CT scan plus MRI and MRV in 26 patients (28.9%), CT scan and MRI in 22 patients (22.2%), and MRI and MRV in 7 patients (7.9%). The numbers of sites of CVT demonstrated by neuroimaging studies were 1 site in 44 patients (48.9%), 2 sites in 24 patients (26.7%), and more than 2 sites in 22 patients (24.4%). The common sites of CVT were superior sagittal sinus in 45 cases (50.0%), transverse sinus in 39 cases (43.3%), cavernous sinus in 30 cases (33.3%), and sigmoid sinus in 20 cases (22.2%). The uncommon site of CVT was superficial cortical vein in 13 patients (14.4%), straight sinus in 9 patients (10.0%), internal jugular vein in 8 patients (8.9%), and deep cerebral vein in 5 patients (5.6%).

Regarding treatment methods, 49 patients (54.4%) were treated with intravenous anticoagulant. Early anticoagulant therapy within 24 hours was administered in 30 patients (61.2%), whereas the other 19 patients (38.8%) were treated after 24 hours. Among them, 4 patients (8.16%) developed intracranial hemorrhage (ICH) after administering anticoagulation therapy. The presence of ICH was found in 33 cases (36.7%). Seven patients (7.8%) of all ICH patients required cranial surgery. Four of the operated cases were anticoagulant therapy-related ICH, whereas the others had spontaneous ICH with massive brain edema and herniation eventually.

Twenty-seven (30.0%) patients had infection-associated CVT. Four patients had intracranial infection

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